Astrophysical Journal 2013 vol.779 N2

New constraints on the cooling of the central compact object in CAS a

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Abstract

To examine the previously claimed fast cooling of the Central Compact Object (CCO) in the Cas A supernova remnant (SNR), we analyzed two Chandra observations of this CCO, taken in a setup minimizing instrumental spectral distortions. We fit the two CCO X-ray spectra from 2006 and 2012 with hydrogen and carbon neutron star atmosphere models. The temperature and flux changes in the 5.5 yr between the two epochs depend on the adopted constraints on the fitting parameters and the uncertainties of the effective area calibrations. If we allow a change of the equivalent emitting region size, R Em, the effective temperature remains essentially the same. If R Em is held constant, the best-fit temperature change is negative, but its statistical significance ranges from 0.8σ to 2.5σ, depending on the model. If we assume that the optical depth of the ACIS filter contaminant in 2012 was ±10% different from its default calibration value, the significance of the temperature drop becomes 0.8σ-3.1σ, for the carbon atmospheres with constant R Em. Thus, we do not see a statistically significant temperature drop in our data, but the involved uncertainties are too large to firmly exclude the previously reported fast cooling. Our analysis indicate a decrease of 4%-6% (1.9σ-2.9σ significance) for the absorbed flux in the energy range 0.6-6 keV between 2006 and 2012, most prominent in the ≈1.4-1.8 keV energy range. It could be caused by unaccounted changes of the detector response or contributions from unresolved SNR material along the line of sight to the CCO.

http://dx.doi.org/10.1088/0004-637X/779/2/186

Keywords

stars: neutron, supernovae: individual (CassiopeiaA), X-rays: stars